Listing of Claims:

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Claim 1. (Currently Amended) A catheter and console combination for mapping a chamber of a heart comprising:

(a) a console comprising driver circuits operatively connected to at least one electromagnetic field generator for generating an electromagnetic field, the console also comprising a signal processor for determining location information;

(b) a catheter comprising:

(i) a body having a proximal end and a distal end, said distal end having a distal tip;

(ii) a contact electrode at said distal tip;

(iii) an array of non-contact electrodes on said distal end of said body, said array having a proximal end and a distal end, wherein said non-contact electrodes are linearly arranged along a longitudinal axis of said body; and

(iv) at least one location sensor on said distal end of said body for generating signals in response to the electromagnetic field which is used by the signal processor to determine a location of said contact electrode and a location of said non-contact electrodes, the location of the non-contact electrodes determined by said signal processor from said signals

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generated by said at least one location sensor, said signal processor using said location of the non-contact electrodes ~~defining~~ to define a cloud of space representing a minimum volume of the chamber geometry of the heart.

Claim 2. (Currently Amended) The catheter and console combination of Claim 1 wherein said at least one location sensor is proximate to said catheter distal tip.

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Claim 3. (Currently Amended) The catheter and console combination of Claim 1 wherein said at least one Amended) location sensor comprises a first location sensor and a second location sensor.

Claim 4. (Currently Amended) The catheter and console combination of Claim 3 wherein said first location sensor is proximate to said catheter distal tip and said second location sensor is proximate to said proximal end of said array of non-contact electrodes.

Claim 5. (Currently Amended) The catheter of Claim 4 wherein at least one of said first location sensor and said second location sensor provides six degrees of location information.

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Claim 6. (Currently Amended) The catheter and console combination of

Claim 5 wherein said first location sensor and said second location sensor each provide six degrees of location information.

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Claim 7. (Currently Amended) The catheter and console combination of Claim 3 wherein at least one of said first location sensor and said second location sensor is an electromagnetic location sensor.

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Claim 8. (Currently Amended) The catheter and console combination of Claim 1 wherein said distal tip contact electrode is a bipolar electrode.

Claim 9. (Currently Amended) The catheter and console combination of Claim 1 wherein said electrode array comprises from about twelve to about thirty-two non-contact electrodes.

Claim 10. (Currently Amended) The catheter and console combination of Claim 9 wherein said array comprises from about sixteen to about twenty-four electrodes.

Claim11. (Currently Amended) The catheter and console combination of Claim 3 wherein said distal tip contact electrode is a bipolar electrode.

Claim 12. (Currently Amended) A catheter and console combination comprising:

(a) a console comprising driver circuits operatively connected to at least one electromagnetic field generator for generating an electromagnetic field, the console also

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comprising a signal processor for determining location information;

(b) a catheter comprising:

(i) a body having a proximal end and a distal end, said distal end having a distal tip;

an array of non-contact electrodes on said distal end of said body, said array having a proximal end and a distal end; wherein said non-contact electrodes are linearly arranged along a longitudinal axis of said body; and

(ii) at least one location sensor proximate to said distal tip for generating signals in response to the electromagnetic field which is used by the signal processor to determine a location of said non-contact electrodes, the location of said non-contact electrodes determined by

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said signal processor from said signals generated by said at least one location sensor, said signal processor using said location of the non-contact electrodes ~~defining~~ to define a cloud of space representing a minimum volume of the chamber geometry of the heart.

Claim 13. (Currently Amended)

The catheter and console combination of Claim 12 wherein said at least one location sensor comprises a first location sensor and a second location sensor.

Claim 14. (Currently Amended)

The catheter and console combination of Claim 13 wherein said first location sensor is proximate to said catheter distal tip and said second location sensor is proximate to said proximal end of said non-contact electrode array.

Claim 15. (Currently Amended)

The catheter and console combination of Claim 15 wherein at least one of said first location sensor and said second location sensor is an electromagnetic location sensor.

Claim 16. (Currently Amended)

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A method for generating an electrical map of a chamber of a heart, said map depicting an electrical characteristic of the chamber as a function of chamber geometry, said method comprising the steps of:

a) providing a catheter comprising a body having a proximal end and a distal end, said distal end having a distal tip; a contact electrode at said distal tip; an array of non-contact electrodes on said distal end of said body, said array having a proximal end and a distal end, wherein said non-contact electrodes are linearly arranged along a longitudinal axis of said body; and at least one location sensor on said distal end of said body;
b) advancing said catheter into said chamber of said heart;
c) using a signal processor to determine ~~determining~~ a location of said contact electrode and a location of said non-contact electrodes using said at least one location sensor wherein the location of said non-contact electrodes defines a cloud of space;
d) contacting a wall of said chamber of said heart with said contact electrode at a plurality of contact points;
e) acquiring electrical information and location information from each of said electrodes and

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said at least one location sensor, respectively, using the signal processor, said acquisition taking place over at least one cardiac cycle while said contact electrode is in contact with each of said contact points; and

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f) determining a minimum volume of said heart chamber geometry with the signal processor using the defined cloud of space from the location of said non-contact electrodes;

g) generating an electrical map of said heart chamber from said acquired location and electrical information.

Claim 17. (Original) The method of Claim 16 wherein said at least one location sensor comprises a first location sensor and a second location sensor.

Claim 18. (Original) The method of Claim 17 wherein said first location sensor is proximate to said distal tip of said catheter.

Claim 19. (Original) The method of Claim 18 wherein said second location sensor is proximate to the proximal end of said array of non-contact electrodes.

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Claim 20. (Original) The method of Claim 19 wherein at least one of said first location sensor and said second location sensor provides six degrees of location information.

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Claim 21. (Original) The method of Claim 20 wherein said first location sensor and said second location sensor each provide six degrees of location information.

Claim 22. (Original) The method of Claim 17 wherein at least one of said location sensors is an electromagnetic location sensor.

Claim 23. (Original) The method of Claim 16 wherein said contact electrode is a bipolar electrode.

Claim 24. (Original) The method of Claim 16 wherein said array of non-contact electrodes comprises from about twelve to about thirty-two non-contact electrodes.

Claim 25. (Original) The method of Claim 24 wherein said array of non-contact electrodes comprises from about sixteen to about twenty-four non-contact electrodes.

Claim 26. (Original) The method of Claim 17 including determining said geometry of said heart chamber from the location information provided by of each of said location sensors.

Claim 27. (Original) The method of Claim 16 wherein said generating step (e) comprises computing the location of said contact electrode and each of said non-contact electrodes, said locations being

the location of said contact electrode and said non-contact electrodes during acquisition of said electrical and location information.

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Claim 28. (Original) The method of Claim 27 wherein said chamber geometry is derived from the location of said contact electrode and each of said non-contact electrodes during acquisition step (d).

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Claim 29. (Original) The method of Claim 28 wherein said electrical map is derived from:

(i) the location of said contact electrode and of each of said non-contact electrodes during acquisition of said electrical and location information; and from

(ii) the electrical information acquired by the contact electrode at each of said contact points.

Claim 30. (Original) The method of Claim 29 wherein said electrical characteristics intermediate said contact points are derived from the electrical information acquired from said non-contact electrodes.

Claim 31. (Original) The method of Claim 27 wherein said electrical map is derived from:

i) the location of said contact electrode and of each of said non-contact electrodes during acquisition of said electrical and location information; and from

ii) the electrical information acquired by said contact electrode and each of said non-contact electrodes.

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Claim 32. (Original) The method of Claim 16, including ablating a portion of said heart chamber based on said electrical map.

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Claim 33. (Original) The method of Claim 32 which further comprises validating the effectiveness of the ablation procedure.

Claim 34. (Original) The method of Claim 33 wherein said validation comprises acquiring additional electrical information from said catheter following said ablation procedure.

Claim 35. (Currently Amended) A method for generating an electrical map of a chamber of a heart, said map depicting an electrical characteristic of the chamber as a function of chamber geometry, said method comprising the steps of:

a) providing a catheter comprising a body having a proximal end and a distal end, said distal end having a distal tip; an array of non-contact electrodes on said distal end of said body, said array having a proximal end and a distal end, wherein said

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non-contact electrodes are linearly arranged along a longitudinal axis of said body; and at least one location sensor proximate to said catheter distal tip;

b) advancing said catheter into said chamber of said heart;

c) using a signal processor to determine ~~determining~~ a location of said non-contact electrodes using said at least one location sensor wherein the location of said non-contact electrodes defines a cloud of space;

d) contacting a wall of said chamber of said heart with said catheter distal tip at a plurality of contact points;

e) acquiring electrical information and location information from each of said non-contact electrodes and said at least one location sensor, respectively, using the signal processor, said acquisition taking place over at least one cardiac cycle while said catheter distal tip is in contact with each of said contact points;

f) determining a minimum volume of said heart chamber geometry with the signal processor using the defined cloud of space from the location of the non-contact electrodes; and

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g) generating an electrical map of said heart chamber from said acquired location and electrical information.

Claim 36. (Original) The method of Claim 35 wherein said at least one location sensor comprises a first location sensor and a second location sensor.

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Claim 37. (Original) The method of Claim 36 wherein said first location sensor is proximate to said catheter distal tip.

Claim 38. (Original) The method of Claim 37 wherein said second location sensor is proximate to the proximal end of said electrode array.

Claim 39. (Original) The method of Claim 35 including ablating a portion of said heart chamber based on said electrical map.

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Claim 40. (Original) The method of Claim 39 which further comprises validating the effectiveness of the ablation procedure.

Claim 41. (Original) The method of Claim 40 wherein said validation comprises acquiring additional electrical information from said catheter following said ablation procedure.

Claim 42. (Currently Amended) Apparatus for generating an electrical map of a chamber of a heart, said map depicting an

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electrical characteristic of the chamber as a function of chamber geometry, said apparatus comprising:

(a) a console comprising driver circuits operatively connected to at least one electromagnetic field generator for generating an electromagnetic field, the console also comprising a signal processor for determining location information;

(b) a catheter comprising:

a catheter including a body having a proximal end and a distal end, said distal end having a distal tip; a contact electrode at said distal tip; an array of non-contact electrodes on said distal end of said body, said array having a proximal end and a distal end, wherein said non-contact electrodes are linearly arranged along a longitudinal axis of said body; and at least one location sensor on said distal end of said body for generating signals in response to the electromagnetic field which is used by said signal processor to determine a location of said contact electrode and a location of said non-contact electrodes, the location of the non-contact electrodes determined by said signal processor from said signals generated by said at least

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one location sensor, said signal processor using said location of the non-contact electrodes to define ~~defining~~ a cloud of space representing a minimum volume of the chamber geometry of the heart; said catheter being adapted to contacting a wall of said chamber of said heart with said contact electrode at a plurality of contact points; said ~~and a~~ signal processor operatively connected to said catheter for acquiring electrical information and location information from each of said contact electrode and said non-contact electrodes and location sensors, respectively, over at least one cardiac cycle while said contact electrode is in contact with each of said contact points, said signal processor also generating an electrical map of said heart chamber from said acquired location and electrical information.

Claim 43. (Original) The apparatus of Claim 42 wherein said catheter comprises a first location sensor and a second location sensor.

Claim 44. (Original) The apparatus of Claim 43 wherein at least one of said first location sensor and said second location sensor is an electromagnetic location sensor.

Claim 45. (Original) The apparatus of Claim 43 wherein said first location sensor is proximate to said catheter distal tip.

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Claim 46. (Original) The apparatus of Claim 45 wherein said second location sensor is proximate to the proximal end of said electrode array.

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Claim 47. (Currently Amended) Apparatus for generating an electrical map of a chamber of a heart, said map depicting an electrical characteristic of the chamber as a function of chamber geometry, said apparatus comprising:

(a) console comprising driver circuits operatively connected to at least one electromagnetic field generator for generating an electromagnetic field, the console also comprising a signal processor for determining location information;

(b) catheter comprising:

a catheter including a body having a proximal end and a distal end, said distal end having a distal tip; an array of non-contact electrodes on said distal end of said body, said array having a proximal end and a distal end, wherein said non-contact electrodes are linearly arranged along

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a longitudinal axis of said body; and at least one location sensor proximate to said catheter distal tip for generating signals in response to the electromagnetic field which is used by the signal processor to determine a location of said non-contact electrodes, the location of said non-contact electrodes determined by said signal processor for said signals generated by said at least one location sensor, said signal processor using said location of said non-contact electrodes to define ~~defining~~ a cloud of space representing a minimum volume of the chamber geometry of the heart; said catheter being adapted to contacting a wall of said chamber of said heart with said catheter distal tip at a plurality of contact points; said ~~and a~~ signal processor ~~for~~ acquiring electrical information and location information from each of said electrodes and location sensors, respectively, over at least one cardiac cycle while said catheter distal tip is in contact with each of said contact points; said signal processor also generating an electrical map of said heart chamber from said acquired location and electrical information.

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Claim 48. (Original) The apparatus of Claim 47 wherein said at least one location sensor comprises a first location sensor and a second location sensor.

Claim 49. (Original) The apparatus of Claim 48 wherein at least one of said first location sensor and said second location sensor is an electromagnetic location sensor.

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Claim 50. (Original) The apparatus of Claim 48 wherein said first location sensor is proximate to said catheter distal tip.

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Claim 51. (Original) The apparatus of Claim 50 wherein said second location sensor is proximate to the proximal end of said electrode array.